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## CLAIMS

1. A filter device (10), particularly for use with an agricultural sprayer, comprising

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a) a casing (15) having a cylindrical wall (14) defining a longitudinal axis (C) of said filter device (10) and having

- a first end (15'),

- a second end (15'') opposite said first end (15'),

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- a liquid inlet (20) formed near said first end (15') in said cylindrical wall (14),

- a first liquid outlet (30) formed near said second end (15'') in said cylindrical wall (14) and

- a second liquid outlet (40) arranged at said second end (15''),

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b) a filter element (90) disposed within said casing (15) for filtering a part of said liquid,

c) a tubular insert member (80) extending within said filter element (90) along said longitudinal axis (C),

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said filter device (10) being adapted to set up a helical flow of said liquid along with and around said longitudinal axis (C) between said tubular insert member (80) and said casing (15),

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said filter element (90) having a filtering medium (F) defining a generally cylindrical wall of said filter element (90), said filter element (90) having a first end (92) and a second end (94) and being open at said first end (92) to allow entry at said first end (92) of said liquid into the interior of said filter element (90),

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said second outlet (40) communicating with the interior of said filter element (90) for allowing discharge of an unfiltered part of said liquid,

5      said filter element (90) having at least one projection (98) extending inwardly in relation to the contour of said cylindrical wall defined by said filtering medium (F),

10     said at least one projection (98) having a face (99) extending in the general direction between said first end (92) and said second end (94) of said filter element (90).

15     2. A filter device according to any of the preceding claims, said liquid inlet (30) being arranged to provide a tangential flow into said casing (15) of said liquid in relation to said cylindrical wall (14) of said casing (15).

3. A filter device according to claim 1 or 2, including means (60) for generating a flow of said liquid around said longitudinal axis (C), said means (60) being arranged within said casing (15) adjacent said liquid inlet (20).

20     4. A filter device according to the preceding claim, said means (60) for generating said flow including a cylindrical wall (68) extending along said longitudinal axis and having at least one port (72) for said liquid, said wall (68) having an outer surface defining together with said casing (15) a first chamber (A) and said wall (68) having an inner surface defining together with said tubular insert body (80) a second chamber (B), said second chamber B communicating with the inside of said filter element (90) at said open end (92).

25     5. A filter device according to the preceding claim, said wall (68) including slanted edges (69, 69') delimiting said ports (72) for guiding said liquid into  
30     said second chamber (B).

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6. A filter device according to claim 1, said second outlet (40) including a valve (44) for allowing a variable discharge of said liquid through said second outlet (40).

5 7. A filter device according to claim 1 or 2, said at least one projection (98) extending parallel with said axis (C).

8. A filter device according to claim 1 or 2, said at least one projection (98) extending helically around said axis (C).

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9. A filter device according to claim 7 or 8, said at least one projection (98) including essentially parallel faces (99, 99').

10. A filter device according to claim 7 or 8, said at least one projection (98) extending continuously between said first and second ends (92, 94) of said filter element (90).

11. A filter device according to claim 7 or 8, said tubular insert member (80) and said filter element (90) extending coaxially with said axis (C) and defining an annular space (D) there between, said annular space (D) having a radial width at said projections (98), said radial width being at least 3%, and preferably in the order of 3%-10%, of the inside diameter  $\emptyset$  of said filter element (90).

12. A filter device according to claim 7 or 8, the inward extension (T) of said projections (98) being selected such that the annular space (D) between the inside surface of said filtering medium (F) and the outside surface of said tubular insert (80) is at minimum 3%, preferably in the order of 3%-10%, of the inside diameter  $\emptyset$  of said filter element (90).

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13. A filter device according to claim 1 or 2, said filter element (90) being a metal or plastics mesh rolled to define said cylindrical wall and including indentations defining said projections (98).

5 14. A filter element (90) having a filtering medium (F) defining a generally cylindrical wall of said filter element (90), said filter element (90) having a first open end (92) and a second open end (94), said filter element (90) having at least one projection (98) extending inwardly from said cylindrical wall defined by said filtering medium (F), said at least one projection (98) having a face  
10 (99) extending in the direction between said first end (92) and said second end (94) of said filter element (90).

15 15. A filter element according to the preceding claim, said at least one projection (98) extending parallel with a longitudinal axis (C') between said ends (92, 94) of said filter element (90).

20 16. A filter element according to claim 14, said at least one projection (98) extending helically around a longitudinal axis (C') between said ends (92, 94) of said filter element (90).

17. A filter element according to claim 14 or 15, said at least one projection (98) including essentially parallel faces (99, 99').

25 18. A filter element according to claim 14 or 15, said at least one projection (98) extending substantially continuously or continuously between said first and second ends (92, 94) of said filter element (90).

30 19. A filter element according to claim 14 or 15, said filter element (90) including a plurality of annular ribs (96) molded integrally with a number of longitudinally extending ribs (97) to provide an essentially rigid support for said filtering medium (F), said filtering medium (F) being a metal or plastics mesh-

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like filtering medium (F) spanning the interspaces between adjacent annular ribs (96) and adjacent longitudinal ribs (97), said projections (98) being molded integrally with said longitudinally extending ribs (97).

- 5 20. A filter element according to claim 14, said filter element (90) being a metal or plastics mesh rolled to define said cylindrical wall and including indentations defining said projections (98).

- 10 21. A filter element according to claim 14 or 15, said inward extension (T) of said projections (98) being at maximum 10%, preferably in the order of 3%-10%, of the inside diameter  $\varnothing$  of said filter element (90).

22. A filter device (10), particularly for use with an agricultural sprayer, comprising

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a) a casing (15) having a cylindrical wall (14) defining a longitudinal axis (C) of said filter device (10) and having

- a first end (15'),

- a second end (15'') opposite said first end (15'),

- 20 - a liquid inlet (20) formed near said first end (15') in said cylindrical wall (14),

- a first liquid outlet (30) formed near said second end (15'') in said cylindrical wall (14) and

- a second liquid outlet (40) arranged at said second end (15''),

- 25 b) a filter element (90) disposed within said casing (15) for filtering a part of said liquid,

c) a tubular insert member (80) extending within said filter element (90) along said longitudinal axis (C),

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23. A filter device according to claim 22, said tubular insert member (80) and said filter element (90) extending coaxially with said axis (C) and defining an annular space (D) there between, said annular space (D) having a radial width at said projections (98), said radial width being at least 3%, and preferably in the order of 3%-10%, of the inside diameter  $\varnothing$  of said filter element (90).

24. A filter device according to claim 22, said inward extension (T) of said projections (98) being selected such that the annular space (D) between the inside surface of said filtering medium (F) and the outside surface of said tubular insert (80) is at minimum 3%, preferably in the order of 3%-10%, of the inside diameter  $\varnothing$  of said filter element (90).

25. A filter device according to claim 23 or 24, said liquid inlet (30) being arranged to provide a tangential flow into said casing (15) of said liquid in relation to said cylindrical wall (14) of said casing (15).

26. A filter device according to claim 23 or 24, including means (60) for generating a flow of said liquid around said longitudinal axis (C), said means (60) being arranged within said casing (15) adjacent said liquid inlet (20).

27. A filter device according to the preceding claim, said means (60) for generating said flow including a cylindrical wall (68) extending along said longitudinal axis and having at least one port (72) for said liquid, said wall (68) having an outer surface defining together with said casing (15) a first chamber (A) and said wall (68) having an inner surface defining together with said tubular insert body (80) a second chamber (B), said second chamber B communicating with the inside of said filter element (90) at said open end (92).

said filter device (10) being adapted to set up a helical flow of said liquid along with and around said longitudinal axis (C) between said tubular insert member (80) and said casing (15),

5    said filter element (90) having a filtering medium (F) defining a generally cylindrical wall of said filter element (90), said filter element (90) having a first end (92) and a second end (94) and being open at said first end (92) to allow entry at said first end (92) of said liquid into the interior of said filter element (90),

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said second outlet (40) communicating with the interior of said filter element (90) for allowing discharge of an unfiltered part of said liquid,

15    said filter element (90) having at least one projection (98) extending inwardly in relation to the contour of said cylindrical wall defined by said filtering medium (F),

20    said at least one projection (98) having a face (99) extending in the general direction between said first end (92) and said second end (94) of said filter element (90),

25    said filter element (90) including a plurality of annular ribs (96) molded integrally with a number of longitudinally extending ribs (97) to provide a rigid support for said filtering medium (F),

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said filtering medium (F) being a metal or plastics mesh-like filtering medium (F) spanning the interspaces between adjacent annular ribs (96) and adjacent longitudinal ribs (97), said projections (98) being molded integrally with said longitudinally extending ribs (97).

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28. A filter device according to the preceding claim, said wall (68) including slanted edges (69, 69') delimiting said ports (72) for guiding said liquid into said second chamber (B).
- 5 29. A filter device according to claim 22, said second outlet (40) including a valve (44) for allowing a variable discharge of said liquid through said second outlet (40).
30. A filter device according to claim 23 or 24, said at least one projection  
10 (98) extending parallel with said axis (C).
31. A filter device according to claim 23 or 24, said at least one projection (98) extending helically around said axis (C).
- 15 32. A filter device according to claim 23 or 24, said at least one projection (98) including essentially parallel faces (99, 99').
33. A filter device according to claim 23 or 24, said at least one projection (98) extending continuously between said first and second ends (92, 94) of  
20 said filter element (90).